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# THE AGRICULTURAL STUDENT

A MONTHLY MAGAZINE DEVOTED TO AGRICULTURAL EDUCATION.

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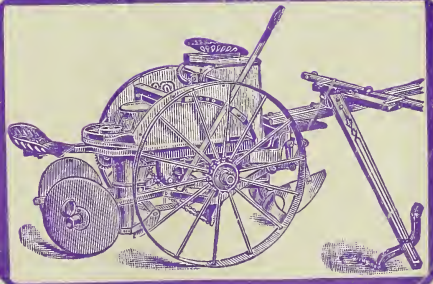

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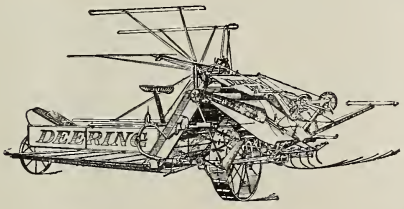


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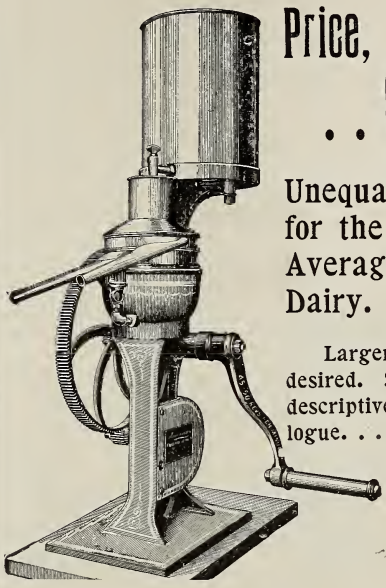

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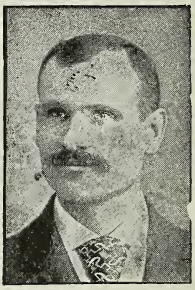

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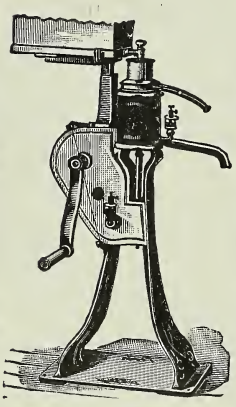

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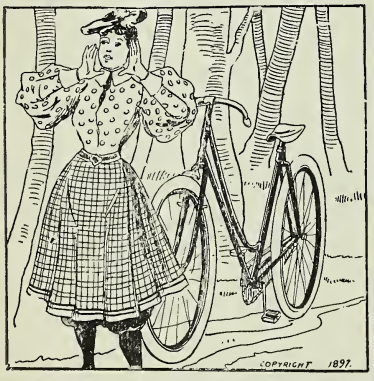


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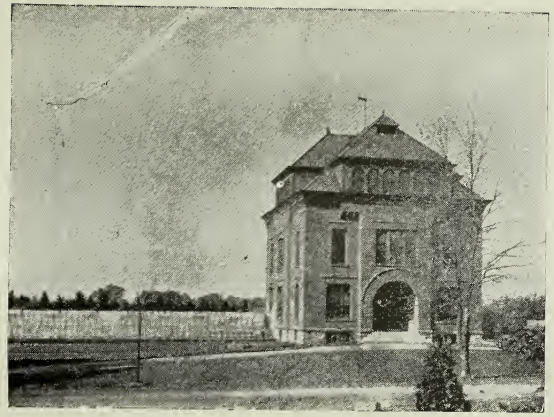
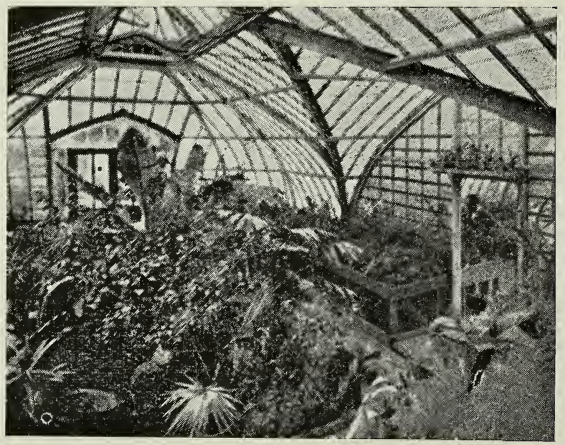


HORTICULTURAL HALL.



IN THE GREENHOUSE.

# THE AGRICULTURAL STUDENT.

VOL. IV. OHIO STATE UNIVERSITY, COLUMBUS, APRIL, 1898. NO. 8.

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M. IMES,

## EDITORIAL CHAT.

There is a value in nature study that most people do not appreciate. When we say "nature study" we do not mean the depths of the natural sciences, zoology, botany, geology and others; it takes time and work, and lots of it, to get even a general idea of these branches. But by nature study we mean that application of rational thought to the common things about us, to study their appearance, general mental effects and their relations with the things about them. In this kind of nature study we abolish systems and classifications, we do away with everything but simple facts. Our objects may be variously constituted and we are not compelled to confine our thoughts to any one division of nature. Today we may study a twig, tomorrow a pebble, then an insect or a mammal. There is always something for us to think about. Whence came they? How, and when? Why is this leaf deeply cleft and that one entire? Why does this bird have habits so different from that one? Let no one say that they have nothing to do, but ask themselves, with Emerson, "Hast thou named all the birds?"

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The Agricultural Student Union of Ohio may prove of much benefit to the farmers of the state by reason of the wide area over which its members are scattered. The effect upon crops of possibly every kind of climate and soil which the state presents could be experimented upon and tested by the members of the Union upon their own farms, and without any appreciable outlay, except that of the care exercised in keeping accurate accounts of the experiments made. It is highly important that we have accurate climatic maps of our country as regards the possibility of raising tender fruits. Members of the Union may, by forming a "co-operative chain," make such tabulations by observing the ratio between time of blossoming of plants and the latest frosts, and all this without the use of a thermometer. When these results were tabulated and a curve made for the frost limit, and another for the time of first bloom, a grower could immediately tell, by reference to his map, whether or no the tender crops could be grown in his locality.

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The plan recently adopted by the state library, by which sets of books may be sent to different parts of the state, will surely be appreciated and taken advantage of by granges, agricultural societies and reading circles. Heretofore the state library has been a luxury that few could enjoy, as the books were not to be taken out by everyone, but under this new plan much good will certainly be done by the spreading of useful knowledge.

### Columbus Horticultural Society.

The regular monthly meeting of the Society was held in Botanical Hall on Saturday, March 26, at 2 p. m. As it was the last meeting of the quarter the reports of the standing committees were made. Interesting reports were made by Mr. J. S. Hine, chairman of committee on entomology; Mr. W. R. Beattie, chairman of committee on cut flowers; Professor Wm. R. Lazenby, chairman of committee on meteorology, and Professor Thos. F. Hunt, chairman of committee on vegetables.

The regular program was then taken up. It was as follows:

"The Economic Value of Some Common Birds," Mr. E. B. Williamson.

"Feeding Habits of Winter Birds of Interior Ohio," Professor D. S. Kellicott.

Many interesting points were brought out in the discussion. The papers themselves were excellent.

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### News Items.

Mr. Philip E. Ward, a former student in the long course in agriculture, was visiting friends about the university on March 29. Mr. Ward is now located at Willoughby, O., but expects to finish his course in the University next year.

Mr. Murray J. Meyers, D. V. M., of the class of '97, was about the University on March 30. His many friends will be pleased to learn of his appointment as meat inspector at St. Louis, Mo.

The recent high waters were unusually "numerous" about the University grounds. The heavy rains did a large amount of damage to the roads and walks upon the campus, the lake was let out by the dam being broken, the greater part of the farm was submerged and the waters had a high time generally.

Mr. Clarence Loveberry, '96, has recently been appointed meat inspector at St Paul, Minn.

Mr. E. J. Riggs, of the class of '95, and who is now instructor in horticulture in the University of New Hampshire, will engage in practical horticulture next year. He has charge of a large fruit farm in Gallia county.

At the last meeting of the Columbus Horticultural Society Prof. Lazenby said that the law recently enacted to protect our song birds was not far-reaching enough to be really effective. He would have it amended by prohibiting the manufacture, sale and use of air guns, sling-shots, pea-shooters and other instruments by which birds can be injured or killed, and by establishing fifteen years as the minimum age at which boys may legally carry fire-arms of any kind for hunting game. Such provisions would not only insure the safety of the birds and other beneficial creatures, but would also aid in promoting the moral and physical welfare of the boys.

The floods in Ohio during the past month have caused the loss of many lives and the destruction of a vast amount of property. As our state is more and more denuded of its primitive forests, floods more disastrous than this may naturally be expected. In addition to preparing for, we ought, as far as possible, to provide against them. The latter can only be done by the judicious growing of forest trees. Forests will not only save us from floods, but protect us from drouth as well.

The following has been found a very satisfactory mixture for lawns:

| | |
|---|---|
| June Grass or Kentucky Blue Grass | 10 lbs |
| Red Top | 10 lbs |
| Perennial Rye Grass | 10 lbs |
| Timothy | 5 lbs |
| White Clover | 5 lbs |

The above is sufficient to seed an acre if the soil is well prepared.

The annual average rainfall in Ohio for the month of March, counting the past fifteen years, has been 2.89 inches. During March of the present year over 6.89 inches have fallen, or 4 inches more than the average. As this excessive rain-

fall was quite general throughout the state, it is little wonder that disastrous floods resulted. It may not be generally known that the three months that have the greatest rainfall in Ohio are May, June and July.

## A Letter.

The following has been sent to each member of the General Assembly by the Columbus Horticultural Society:

Columbus, Ohio.

To the Hon. ————————, Member of the 73d General Assembly:

Dear Sir—We, the undersigned, representing the Columbus Horticultural Society, beg leave to call your attention to the importance, the urgent necessity of enacting House Bill 393, introduced by Mr. Gayman.

Probably no state in the Union was supplied by nature with a more varied and generous covering of timber than Ohio. For more than a hundred years this magnificent forest area has been yielding to the demands of agriculture, manufacture and commerce, until only a small percentage remains.

Considered from a strictly utilitarian point of view the necessity for prompt and liberal measures to restore and preserve our remaining forests is urgent and pressing. The prevention of injurious floods and subsequent periods of drouth; of untimely frosts and destructive winds; the abundance and purity of our water supply; the increase of insect enemies; the failure of crops from lack of moisture, are vital questions.

While we have been cutting down our forests most improvidently, developing a tree destroying instinct, France, Germany and other countries of Europe have declared that trees must be protected by the state, and have formulated into law the lessons taught by experience.

This experience shows that from one-fourth to one-third of any considerable area of country should be occupied with trees, "to preserve the balance of nature" and thus secure the best results in the productiveness of the soil and consequent ability to support a large and constantly increasing population.

Where stands Ohio in this respect? What is the ratio at present between the wooded and the cleared portions of our state?

While the statistics are not so complete as we might desire, it is safe to say that the proportion of timber land is not more than one-tenth of the total area.

New York, Pennsylvania and other states are awakening to a realization of the value of their forests. All civilized nations of Europe have long since enacted laws for the preservation of trees and for the re-establishment, in part, of the original area. Shall the great state of Ohio be blind to her future welfare? Shall we by short sighted selfishness and negligence destroy this magnificent inheritance of soil and climate? Shall we devastate this fair commonwealth by flood and make it a desert with drouth? Shall we make our state a prey to tornadoes and cyclones, and see its fruitfulness blasted by frost and hail? Is there any crime against nature that draws down a more terrible curse than that of stripping the earth of all her forests? We do not object to the removal of forest trees after they attain their highest market value, nor do we expect the farmer to give up his most productive land to the raising of a crop of timber which must take fifty years or more to mature. All that the friends of the Ohio forests ask is that all the land that cannot be cultivated or is cultivated at a loss, shall be set apart for timber growing, and that for every tree cut down at least two better trees shall be planted and reared until one-fourth of the area of the state is reclothed with trees. We are confident that a large majority of our farmers would improve their circumstances and increase their income by concentrating their efforts, applying their labor, and fertilizers upon two-thirds of the area they now too often

skim and skin, and giving the residue back to timber growing.

The Gayman bill seeks to "promote the preservation and planting of forest trees," by an easement of taxation and by the establishment of forestry stations.

The object of the stations is to illustrate how best to conserve and improve existing woodland; to establish suitable nurseries and forest plantations for the common good; to encourage the production of wood as a farm crop; to exemplify the best methods of forest planting and management; to advance the cause of scientific and practical education in forestry, and to report to the governor and legislature, annually of progress and results.

Trees are a great blessing to man. They charm by their grace and beauty; they comfort by their shade and companionship; they energize by their health-giving and inspiring influence. Our forests are the great laboratories of nature. They are the conservators of public health and public wealth. They are the most effective sanitary agents and are equally indispensible to commercial success. Let us save the forests.

(Signed.)

WILLIAM R. LAZENBY,
President.

JOHN F. CUNNINGHAM,
Secretary.

---

## The Pollination of Clover.

By John C. Britton.

It seems to be a part of human nature for a person to believe a statement and take it for granted as long as it is not disputed. If the dispute be brought forward by a person of good judgment and educated along the line of the subject in question, the tendency is to at least consider his objection and give some weight to his argument. It therefore leaves one in the dark as to whether the statement be wrong or right.

Since taking my first lessons in botany I have been taught that the flowers of all plants, in order to produce fruit and seed, must be fertilized in some way by an interchange of pollen grains. This pollination is brought about by various agencies, such as the wind, insects, mechanical contrivances and every group of plants is usually limited to some one of these methods.

It has long been believed that the bumble-bee is about the only insect that can perform this act of pollination for the common red clover plant, to an extent that could be considered of economic importance. This I never thought of disputing until some one said that the bumble-bee has very little to do with the production of red clover seed. As there had, to my knowledge, been no experiments made to prove or disprove the statement, the only thing to do was to perform a simple experiment and settle the matter for myself. The experiment was conducted as follows

I made a box six feet square and about twenty-five inches high. It was open at both ends but the top was covered with common mosquito bar. This I placed in a clover field on the O. S. U. farm before any of the plants had blossomed.

When the first crop of clover was cut for hay I removed the box and picked one hundred matured clover heads that had grown under the screen. At the same time I collected one hundred heads that had grown in the open air near the box. The box was then placed over other plants and allowed to remain until the second crop had matured. One hundred heads were again collected from under the box and one hundred from the outside as before. Beside these I picked one hundred heads from plants growing near a bumble-bees' nest. Each bunch, of course, was kept separated from the others. After drying the clover heads in a mild oven, the seeds were carefully removed and counted. The result, showing the number of seeds in each one hundred heads, was as follows

| | |
|---|---|
| First Crop (Covered) ..... | 0 |
| First Crop, (Uncovered) ..... | 10 |

| | |
|---|---|
| Second Crop (Covered) ..... | 2 |
| Second Crop (Uncovered) ..... | 612 |
| Heads From Near Bumble-bees' Nest ..... ..... ..... | 2300 |

The two seeds, which were produced under the box in the second crop, may have been the result of wind pollination.

Of course all other insects as well as bumble-bees were excluded, as it would be next to impossible to make any distinction; but certainly no one will doubt that bumble-bees are the principal workers in the pollination of clover blossoms.

## The Dairy School.

The course in dairying familiarly known as the dairy school, closed on the 19th of last month and the students are now scattered, many of them having secured work in creameries and cheese factories. The students all expressed themselves as more than satisfied with the instruction and experience which they gained. The session just closing has been in point of attendance, the most successful in the history of the dairy school. The preparation of the students, as a rule, has been of a higher order than formerly. Although the requirements for admission to this special course are proficiency in the common branches only, a little inquiry shows that several of the students have had High school training, while one has been a student of the Wageningen Agricultural College, Holland. There have been thirty students taking the ten weeks course, while fourteen students in the two and four years' courses in agriculture received instruction as a part of the required work of these courses. There is one student from Mexico; one from North Carolina; one from Maryland; one from New York; two from Pennsylvania; two from Illinois.

The interest shown in this work by farmers and others has been greater than ever before. In fact the number of visitors has been so large that although all are welcome they have been a positive tax upon the time of instructors. Probably not less than 2000 people have visited Townshend Hall and its dairy rooms during the winter term.

## A Veteran Mower.

One of the most attractive features of our new museum is an old Ketchum mowing machine, the first make that was successfully used for any length of time.

This individual machine was purchased in Cleveland July 4, 1854, for $116, by Colonel L. B. Nettleton and transported by wagon to his farm near Medina, where the following day it was set up and put at work. As it was the first mowing machine bought in the county, farmers from all over the county came to see the machine that was to revolutionize haying. It was so much of a success that later in that season and the next season several similar machines were purchased in the county. This machine was in active use for about twelve years, not only doing the mowing on the farms of Mr. Nettleton, but also doing largely the mowing on the neighboring farms.

It was usually drawn by two horses, although when mowing all day, a third horse was hitched ahead; this not only lessened the draft, but also greatly eased the side draft occasioned by so much weight being thrown on the cutter bar, which ran on heavy broad shoes.

The machine is in a fairly good state of preservation, although showing much wear. The present cutter bar is the second one; the first, merely a plank with the guards driven into it, became broken and a new one had to be put in. The pole also shows a considerable wear where the neckyoke ring came, the half-inch strap of iron being worn through, and one side of the wood badly worn from the side draft. The machine being hard of transportation, having only one wheel, the owner made an invention to overcome this difficulty, which consist-

ed in bolting a short piece of plank on in place of the cutter bar which acted as a spindle on which was placed a small plank wheel, this proved to be a great improvement as it could now be run on the road, while before it had to be loaded into a wagon when being moved any distance.

This machine, placed in the museum with the machines of the most approved patterns, serves two purposes; first, to show off the new machines, and second, as a relic of early agricultural machinery.

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### European Methods of Dairying.

Professor John W. Decker, instructor in the Dairy School of Wisconsin, was a delegate to the Cleveland Meeting of the Students' Volunteer Movement, and while in the state took advantage of the opportunity to visit the University. While here he delivered a lecture upon "European Methods of Dairying."

Last summer Professor Decker spent ten weeks in Europe, mostly in England, Holland, Denmark and the Channel Islands. Being a veteran wheelman, he was enabled to seek nooks and corners not visited by professional sightseers and to go from dairy or from factory to factory, spending as much or as little time as circumstances warranted. Being an amateur photographer, he was enabled to return with some of the sights which he had seen and which he exhibited to his audience. Professor Decker had secured a most interesting and valuable collection of photographs which were mounted in sets on large card boards, which, with the descriptive notes underneath the photographs, formed an interesting and valuable pictorial description of the countries through which he traveled.

The part of Holland above Amsterdam is called New Holland and there the Edam cheese is made. The part of Holland south of Amsterdam is called South Holland and there the Gouda cheese is made. Most of the cheese is made in farm dairies, though some is made in factories. Friesland is a part of Holland east of the Zuyder Zee. Here are the butter factories of Holland. Skimmed cheese is made from the milk. It is pressed into unbandaged cakes and is called Friesian cheese. A photograph shows the cheese market at Hoorm, where over ten thousand cheeses, four and eight pounds each are made. Straw is laid on the stone pavement and Edam cheese piled on the straw and cloths put over them to keep off the sun. These cheeses are weighed on huge balances by placing weights of equal weight on the other scale pan. In judging the quality of cheese texture seems to be of greater importance than odor or taste. When cheese is on the market it is plugged by the intending purchaser and if satisfactory it is bought, whereupon buyer and seller shake hands vehemently. If not purchased the owner turns the cheese over to conceal the previous plugging from buyers.

The cattle of Holland are what are called Holstein-Friesian in this country. In Holstein, a province of Germany farther east, the cattle are of a different type, so that the name Holstein cattle is incorrect. About 90 per cent. of the cattle are black and white, and about 10 per cent. are red and white. Great care is taken of the cattle. They are protected from the cold winds by a blanket. One of the photographs shows people washing cattle at the canal. Cows are stabled from November to May and in pasture from May to November. A photograph typical of the cleanliness of the stables was shown, in which Edam cheese was curing. The dairy products of Holland are transported upon the level and most excellent country brick roads upon carts drawn by dogs.

Denmark was next visited. Denmark sends 23,000,000 pounds of butter to

England each year. This butter is made in 200 creameries. The success of Danish butter is due to its uniformity. This uniformity is due to two things. First, the cream is pasteurized, thereby killing bad fermentations, and pure cultures are used to ripen it, thereby giving it a uniform flavor. In reply to a question Professor Decker stated that he did not believe any better butter was made from pasteurized milk and pure cultures than could be made from milk with which special care had been taken. The second cause for uniformity in Danish butter is the system of government inspection which remedies defects. Seven hundred and fifty of the 1200 creameries are under government inspection. The inspection is under the supervision of Director Emil Hohn at the experiment station at Copenhagen. Every two weeks Hohn telegraphs a creamery to send a firkin of butter by the first train. The butter is put into a butter scoring house at a low temperature. In this house are three rooms and in each room are thirty samples from as many factories. There are three judges. Each judge in the room scores the butter independently of the others. The average of the three scorers is reported to the butter maker with suggestions for remedy of defects. The judges are butter merchants and know what the market demands.

One of the photographs shows a statue of Dr. Fjord, erected in front of the experiment station building at Copenhagen. Dr. Fjord invented a milk tester, not as good as the Babcock test, but it was a great help to Danish creamery men.

Professor Decker spoke briefly of his visit to the island of Jersey and Guernsey. Guernsey is but seven miles in its longest extent and has a population of 34,000, one-half of which is in the city of St. Peters Port. There are 4000 milch cows on the island. Jersey is a little larger than Guernsey and has a population of 56,000, of which 30,000 are in the city of St. Heliers Port. The population of this island is so large that after being supplied with milk there is not enough butter to supply the demand. The islands have provisional government and have their own coins, but are subject to England. Cattle cannot be imported alive but must be slaughtered at the ports of entry. Jersey and Guernsey cattle taken to the agricultural shows in England cannot be returned alive. This insures uniformity in the breed.

The pastures on the islands are very luxuriant from an American standpoint and the cattle are universally tethered.

American butter and cheese find an increasing sale in England but more care should be given to packing it. Butter is sent abroad in firkins made of unsuitable wood which often gives an unsavory taste to the butter. Canadians are more careful than we are in this matter hence their product is preferred to ours. When American cheese sells for more than 11 cents a pound cheap meats are substituted for food.

Professor Decker said that the dairy department of the Ohio State University had the best equipment of any institution up to date.

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### Judging Sheep.

The livestock judging room in Townshend Hall has made possible a new feature in connection with the instruction given by the Department of Agriculture of the Ohio State University, viz.: Loaning for a short time of specimen animals of different breeds of livestock for the purpose of enabling the student to become familiar with the different types of animals and to correctly judge them.

During the first week in March, twenty-seven head, including nine breeds or types of sheep, were brought together from various parts of the state. Coming as they do from breeders who make one or two types a specialty, it is possible to get together by this method a more representative lot of sheep than would be possible if the University attempted to

breed all the different types with the means that it now has at its command.

The following list shows the breeders who contributed without charge, the several breeds for this purpose:

American Merinos, from R. D. Williamson, Xenia; Delaine Merinos, from W. P. Penry & Bro., Radnor; Rambouillets, from E. O. Lincoln & Son, Milford Center; Dorsets, from Joseph E. Wing, Mechanicsburg, O.; Southdowns, from F. F. Robinson, Hanover; Shropshires, from C. Hills & Son, Delaware; Oxfords, from J. C. Williamson, Xenia; Oxfords, from Heskett Bros., Fulton; Hampshires, from E. H. Furniss, Galena; Lincolns, from H. P. Miller, Sunbury.

Mr. H. P. Miller, Sunbury, Ohio, a graduate of the University in the course in veterinary medicine, and an expert judge of sheep, was secured to take charge of the judging. A score card had been prepared which indicated, as far as the limit of a score card can, the desirable and undesirable points of sheep, whether for wool or for mutton. Each afternoon several sheep of a certain general type were brought out and each student was required to score each animal and thereby to indicate which animal was the best and give the reasons.

The first afternoon Mr. Miller gave a lecture, explaining the score card and the principles of judging. The second afternoon he lectured upon the types of mutton sheep, while the next afternoon the wool sheep were similarly treated, in each illustrating his points with the animals before him. The last afternoon each of the sheep were pointed out at random and each student was required to state breed together with the age.

Great interest was taken in the work by the students and doubtless much good to the interests involved will accrue from it. It should perhaps be stated that this work is supplementary to the regular course in Animal Industry, the students having studied previously the history, characteristics and adaptations of the various breeds of sheep, as well as having made a study of wool including its structure, classification and uses.

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## Barn Building.

Abstract of address on barn building, delivered at Townshend hall, March 10, by John L. Shawver, Bellefontaine, Ohio:

Mr. Chairman and Students of the Ohio State University: It affords me pleasure to meet with you here at this hour. You are engaged in good work under faithful instructors and will go forth far better equipped for the duties of life, by the training you get in this grand institution.

But I come to talk to you on a very plain subject and shall not attempt to embellish it with any glowing language, but state the facts in plain words for your consideration.

You have before you a model of a plank frame barn. You have had ample opportunity to examine into its merits and its defects during the past several weeks that it has been on exhibition in the lobby of this building. Frames have been constructed of plank for some twenty-five years or more but it has been in the last few years that the system has been perfected and applied to any great extent in the building of barns.

At first there seemed to be a tendency of the farmer to think that if some one would show him how to save one-third his timber he would do well and save much more, so some barns were built without sufficient timber for the purpose and they proved unsatisfactory. But we can usually save from forty to sixty per cent. of the timber, and by constructing the frame so as to get the greatest possible use of the timbers placed therein get a strong and substantial frame.

We are not finding any particular fault with our grandfathers because they used enormous timbers in their barns. They wanted the use of the land. The

timber must be removed. If they burned the logs in the clearings it was extravagant waste. If they placed it in barns it was preserved for the present generation to cut up into stove wood. You perhaps know of barns from which much of the timber has been cut out in recent years to permit the use of the horse fork or hay slings. In this frame you have an open center and no timber to interfere with the handling of hay and grain.

This frame can be constructed with very much less labor than the old style. You notice there is not a mortise or tenon in the entire frame. If any of you ever served an apprenticeship at the carpenter trade he knows what it is to turn a two-inch auger in a hard pin oak beneath the burning rays of an August sun. As examples of what may be done I might say that with three carpenters we framed a barn 40x72 in three days. Another barn, 40x80, with 24-foot posts and stables throughout with three carpenters we framed in three days. A dairy barn, 36x100, with eight-foot basement and sixteen-foot superstructure was commenced with the aid of four house carpenters of New York City, none of whom had ever done any barn work, and two laborers on Monday and the barn was raised basement and superstructure complete, on Friday of the same week.

The saving of timber relieves the farmer from very much heavy hauling; the saving in labor relieves him of a good share of the wages and relieves his wife of a number of days' work in cooking and providing for the welfare of the men.

Smaller timber may be used out of which to obtain the bill stuff, and there is practically no waste of timber for almost every piece can be used somewhere to advantage.

The truss supporting roof prevents either collapsing or spreading, two difficulties that have always defeated the carpenter who sought to make a mortise and tenon frame with open interiors. By combining the timbers, forming triangles, and using long braces wherever possible we get a much stronger frame in proportion to the timber used than is otherwise possible.

This system needs only to be understood to be appreciated. Mr. Noah Rinehard, of Montgomery county, this state, for whom we built a barn in June of last year, informed me last week that he afterwards sold his farm, purchased another and at once built a plank frame barn on it. He further stated that if he were to build a dozen barns they should all be of plank.

My friend, Mr. Devol, of Marietta, who was one of the first to adopt our system, built a second barn on the same plan three years ago. I frequently get letters from those who have built stating that although their carpenters and neighbors endeavored to dissuade them, they all now endorse it.

Purdue University of Indiana ordered a model for use before their agricultural students.

Pennsylvania State College built a barn from one of our models last autumn.

We receive inquiries from many states; from New Brunswick to Oregon, and from Ontario to Texas.

I believe if properly constructed it is much more desirable than the old system. People tell me it is a good thing and you can scarcely blame me much, if I believe it is a good thing myself.

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## Some Observations on Soil Moisture.

### O. S. U. Farm.

By W. D. Gibbs.

During the recent flood a considerable part of the University farm was under water for three days. After the water subsided the amount of moisture was determined in the overflowed soil as follows:

Fall plowed clover sod, per cent. of water calculated to water free soil, 33.9;

weight of water per cubic foot of soil, 27.23; amount of water in surface foot expressed in inches, 5.27. Unplowed clover sod, per cent. of water calculated to water free soil, 35.8; weight of water per cubic foot of soil, 25.09; amount of water in surface foot expressed in inches, 4.31; wheat stubble, per cent. of water calculated to water free soil, 36.6; weight of water per cubic foot of soil, 25.62; amount of water in surface foot expressed in inches, 4.91.

From this table it will be seen that the amount of water in saturated soil is very large, amounting in this case, to more than twenty-seven pounds per cubic foot in the fall plowed clover sod. Or, in other words, the surface foot of soil retained more than five inches of water. The fall plowed clover sod contained more moisture than the unplowed, and also more than wheat stubble ground. This would be expected from the fact that the plowed ground was more open and spongy and that the water table was practically at the surface of the soil, hence more hydrostatic water was included in the samples as they were taken from the field.

In connection with these results it may be of interest to note the moisture conditions of the soil during the growth of the corn crop last season. The season was very favorable to the growth of corn, and the soil averaged about 25 per cent. of moisture. This gives 17.5 pounds of water per cubic foot, or 3.35 inches of water, as compared with 5.27 inches in the very wet soil.

The dry wheat fields of September, 1897, contained much less water. During last August and September "High street" field was thoroughly prepared for wheat seeding, but owing to extreme drouth only a part of the seed germinated, leaving patches of ground bare. Moisture was determined in the surface foot of this soil as follows:

Wheat growing, per cent. of water calculated to water free soil, 12.55; weight of water per cubic foot of soil, 9.32; amount of water in surface foot expressed in inches, 1.73. Wheat not growing, per cent. of water calculated to water free soil, 8.67; weight of water per cubic foot of soil, 6.47; amount of water in surface foot expressed in inches, 1.24.

The soil having 1.73 inches of water in the surface foot contained barely enough to germinate the wheat? Hence some point between 1.73 inches and 1.24 inches is the lowest limit for wheat growth for this soil.

From the above results it appears that, for our soil, 1.5 inches of water per cubic foot is near the lower limit for growth, while 3.5 inches is about the most favorable amount, and 5.5 inches the saturation amount.

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## A Note on Two Species of Long-Horned Beetles Injurious to Timber Trees in Ohio.

The interest taken in forestry at the present time revives with other things, the entomological side of the question. There are some trees that do not have many enemies among insects, while there are others that are nearly destroyed by them. As an example of the latter you are referred to the yellow locust, *Pseudocacia robiniae.* Several years ago a fine locust grove was started on the University farm near the river. The plants grew well for a time, but soon some began to show the effects of insect attack and later some died. The appearance of the grove became worse from year to year, until finally it was pronounced worthless and disposed of. Other locust trees planted on the farm at various times have died or become worthless within a few years after planting.

The insect that does this injury is known as the locust borer or *Cylene robiniae*, Forst. The adult appears in September and may often be seen on the flowers of golden-rods. In fact they are often so common on these flowers in the vicinity of locust trees that hundreds of the beetles may be taken in a small space.

It seems to be unwise to attempt to grow locust trees at the present time in central Ohio because of these insects. The wood of this tree is highly prized for certain purposes and it is a question what we shall grow to take its place, unless it be the catalpa, *Catalpa speciosa*, as some have suggested.

Practically the only apparent way of preventing the ravages of the locust borer is to quit planting the locust tree.

Another closely related insect is the hickory borer, *Cylene pictus*, Drury, which lives during its larval stage in the various species of hickory. These two forms are very much alike in size and coloration, but as the hickory borer appears as an adult in April and May, it may be known from the locust borer which appears in September.

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## A List of the Fish of Franklin County, Ohio.

By R. C. Osburn and E. B. Williamson.

1. Lepisosteus osseus (Linn). Observed by us only in the Scioto river, where it is abundant.

2. Ictalurus punctatus (Raf). Most abundant in Big Walnut creek, where it is of considerable value as a food fish.

3. Ameiurus lacustris (Walbaum). Rare, only two specimens taken in Big Darby creek. The female, weighing 4 1-2 pounds, contained eggs.

4. Ameiurus natalis (Le Sueur). Common wherever found, with Ameiurus melas, next to which it is the most abundant Ameuirus.

5. Ameiurus vulgaris (Thompson). Rare, only two specimens from the canal along the Scioto river, south of Columbus.

6. Ameiurus nebulosus (Le Sueur). Common in the larger streams.

7. Ameiurus melas (Raf). The most abundant of our catfish, occurring in nearly all streams, with nebulosus and natalis constituting the "catfish" and "bullheads" of the youthful angler. Females were taken with ripe eggs on June 22, 1897.

8. Noturus flavus, Raf. Abundant on stony ripples in all the larger streams of the county.

9. Schilbeodes gyrinus (Mitchill). Rare, only two specimens, one from Big Darby, the other from Mason's Run.

10. Schilbeodes eleutherus (Jordan). Very rare; a single specimen of this rare species from Big Walnut. Distinguished from S. miurus by the free adipose fin, relatively longer upper jaw, and darker and more uniform coloration.

1. Schilbeodes miurus (Jordan). Generally common, abundant in Big Walnut. Females with eggs from June 25 to July 6, 1897.

12. Carpiodes velifer (Raf). This species ascends the smaller streams, during the high waters of spring, to breed, retreating to the deeper waters of the rivers in May, but frequently becoming landlocked. Of much importance as a food fish during the spawning and migratory season, when they are readily taken with seines.

13. Catostomus commersonii (Lacépède). Taken in every stream; the commonest sucker.

14. Catostomus nigricans, Le Sueur. Common in all but the smallest streams.

15. Erimyzon sucetta (Lacépède). Taken only in the Scioto and in streams west of the Scioto where it is generally abundant. A few specimens from Scioto Big Run were, in life, a bright "goldfish" yellow.

16. Minytrema melanops (Raf). Our handsomest sucker; rare, but of general distribution.

17. Moxostoma anisurum (Raf). Not common, observed only in the larger streams.

8. Moxostoma aureolum (Le Sueur). Abundant, taken in all but the smallest streams.

19. Placopharynx duquesnii (Le Sueur). Taken only in the Scioto, Olentangy and Big Darby; not common. Not

readily distinguished from the preceding species.

20. Campostoma anomalum (Raf). Very abundant everywhere. Frequently observed in large schools on ripples.

21. Chrosomus erythrogaster, Raf. Occurring in abundance in brooks flowing into the Scioto from the west.

22. Pimephales notatus (Raf). The most abundant of our minnows, occurring in great numbers in every stream. Females were taken with eggs on July 1, 1897.

23. Semotilus atromaculatus (Mitchill). In every stream, generally abundant, especially at the head-waters.

24. Abramis crysoleucas (Mitchill). Generally common in the western part of the county, rare east of the Scioto.

25. Cliola vigilax (Baird and Girard). Rare, a single specimen from Big Walnut. Superficially this species very much resembles Pimephales notatus.

26. Notropis cayuga, Meek. Rare in Big Walnut and Little Darby, common in Mason's Run.

27. Notropis blennius (Girard). Common in almost every stream.

28. Notropis shumardi (Girard). Rare in Big Walnut creek.

29. Notropis whipplei (Girard). Our handsomest and one of our commonest minnows, taken in all the larger streams. Females with eggs were taken on June 28, 1897.

30. Notropis cornutus (Mitchill). Taken in every stream, generally abundant. Females with eggs on July 6, 1897.

31. Notropis atherinoides, Raf. Taken commonly in all the larger streams; a handsome minnow but shedding its scales at the slightest touch.

32. Notropis rubrifrons (Cope). Occurs generally with N. atherinoides; abundant where found.

33. Notropis umbratilis lythrurus (Jordan). All streams but the smallest; abundant, and one of the handsomest minnows. Females with eggs observed June 29, 1897.

34. Ericymba buccata, Cope. Generally abundant, taken in every stream in the county; found in quiet, sluggish waters with Pimephales notatus. Females with eggs on June 15, 1897.

35. Rhinicthys atronasus (Mitchill). Occurring with Chrosomus erythrogaster in small brooks flowing into the Scioto; less abundant than the latter species.

36. Hybopsis dissimilis (Kirtland). Rare, taken only in Big Walnut. We have only four specimens.

37. Hybopsis amblops (Raf). Occurring commonly in all but the smallest streams.

38. Hybopis kentuckiensis (Raf). Taken rather commonly in all the larger streams. Females with eggs on July 16, 1897. A minnow of the general appearance of Semotilus from which it is distinguished, however, at a glance by the larger scales, absence of black dorsal spot, and by the smaller, horizontal, inferior mouth.

39. Cyprinus carpio, Linn. Of general distribution throughout the county. Specimens of large size are taken in the rivers. Immense numbers swarm in the canal south of Columbus, where many are taken with hooks and lines and with dip-nets. Both the English or Full Scale and the Mirror or Half-Scale, as they are commonly called, occur.

40. Anguilla chrysypa, Raf. Probably occurring in all the streams of the county; reported to us by fishermen as not rare; observed personally only in Big Walnut.

41. Umbra limi (Kirtland). A single specimen, 4 1-2 inches in length, was taken April 3, 1897, near the mouth of a small tributary of the Olentangy.

42. Lucius vermiculatus (Le Sueur). Of general distribution, abundant in Hell Branch. Specimens reaching a length of fourteen inches were taken in Big Darby. A gamey and interesting little fish.

43. Fundulus notatus (Raf). Of general distribution, abundant in places. Females with eggs taken on June 14, 1897.

44. Percopsis guttatus, Agassiz. Abundant in streams west of the Scioto; only one specimen from the Big Walnut system; after some hauls in Scioto Big Run the seine contained more of this than of all other species combined.

45. Labidesthes sicculus (Cope). Of general distribution, generally abundant.

46. Pomoxis annularis, Raf. Abundant wherever found; frequenting grassy and weedy places. Dorsal spines 5, 6 or 7 in number.

47. Pomoxis sparoides (Lacépède). Not common. Dorsal spines 7 or 8.

48. Ambloplites rupestris (Raf). A common food and game fish occurring throughout the county. Females with eggs observed on June 29, 1897.

49. Apomotis cyanellus (Raf). A common and variable sunfish, found everywhere. Taken with eggs June 15, 1897.

50. Lepomis megalotis (Raf). Apparently the commonest sunfish. Taken with eggs on June 18, 1897.

51. Lepomis pallidus (Mitchill). Rare, only a few specimens taken. Observed with eggs June 14, 1897.

52. Eupomotis gibbosus (Linn). Not common, taken, with the preceding species, only in the larger streams.

53. Micropterus dolomieu (Lacépède). Generally abundant. Known to the local fishermen by a variety of names depending on the age and coloration of the specimens.

54. Micropterus salmoides (Lacépède). Not common; taken only in the larger streams.

55. Percina caprodes (Raf). Of general distribution; common, but nowhere abundant.

56. Hadropterus phoxocephalus (Nelson). One specimen from the Big Walnut at Lockbourne.

57. Hadropterus aspro (Cope and Jordan). A common darter of general distribution.

58. Diplesion blennioides, Raf. Of general distribution; abundant.

59. Boleosoma nigrum (Raf). Taken in every stream; generally abundant. Females with eggs April 3, 1897.

60. Ammocrypta pellucida (Baird). Not common, taken on sand bars in the larger streams. Observed with eggs on June 28, 1897.

61. Etheostoma variatum, Kirtland. Rare.

62. Etheostoma zonale (Cope). Common where found.

63. Etheostoma camurum (Cope). Taken only on swift ripples in the larger streams.

64. Etheostoma maculatum, Kirtland. Rare, a single female with eggs from Big Walnut creek on June 26, 1897.

65. Etheostoma coeruleum (Storer). Of general distribution; abundant.

66. Etheostoma coeruleum spectabile (Agassiz). This brook variety occurs only in the small streams of the county; grading insensibly into the typical species.

67. Etheostoma sciotense, Osburn and Williamson. Head $3\frac{1}{2}$; depth $4\frac{1}{4}$; eye small, $4\frac{1}{2}$ in head; D.XII-12; A.II-7; scales 6-46-8; lateral line straight, developed on about thirty scales. Body compressed, caudal peduncle deep, back little elevated, profile somewhat depressed at nape. Head rather small, little compressed; mouth large, terminal, oblique, the lower jaw somewhat included; lips thick, premaxillaries not protractile, maxillary reaching to pupil. Opercle short, spine moderate; gill membranes scarcely connected; a small, well defined, black humeral scale. Cheeks, breast and throat, and region in front of and on either side of first dorsal fin naked; opercles scaled. Vertical fins high; dorsals slightly connected; soft dorsal and anal about equal in size; first anal spine the longer; caudal truncate, slightly emarginate; pectorals reaching to or beyond tips of ventrals. Color in life, male, body dark olive green, strongly tinged with yellow, especially posteriorly; lighter anteriorly, shading into greenish yellow on belly; with about fourteen narrow

well defined vertical greenish black bands, most distinct posteriorly where they entirely encircle the body, the last one broadest and most conspicuous; breast a deep blue black, continuous with that of the ventrals and extending well up on the neck. Dorsal and anal fins golden yellow, heavily pigmented with blue black at their bases, a distinct black spot on front of first dorsal; caudal deep golden yellow, less heavily pigmented with blue black; pectorals golden yellow, unmarked; ventrals golden yellow, blue black at base. Female paler, dark markings less distinct; pectorals pale olive; other fins dark, edged with pale yellow; black spot on front of first dorsal well defined. Color in spirits, general color dark olive, lighter below, each scale with a vertical dusky line; bands black, narrower than the interspaces; breast and throat dark. Vertical fins dark, edged with light; a black spot on front of dorsal; ventrals black with a light margin; pectorals light, unmarked; a black spot at base of caudal. Length $1\frac{1}{4}$ inches.

Taken in the Olentangy river and in Big Walnut creek, tributaries of the Scioto river, near Columbus, Franklin county, Ohio. Two of the types are in the National Museum and the third is in the collection of President D. S. Jordan. These type specimens are from Big Walnut creek. This species lives in the swiftest ripples with Etheostoma flabellare, E. variatum, E. camurum, etc. From E. tippecanoe, which it most resembles, it is distinguished at once by coloration and by the absence of scales on the nape and anterior dorsal region.

68. Etheostoma flabellare, Raf. Abundant; some of our specimens approach the variety lineolatum.

69. Cottus ictalops (Raf). Four specimens were taken in Brackenridge's Run.

Note—The nomenclature used in the above list is that of Jordan and Evermann's "Check-List of the Fishes and Fish-Like Vertebrates of North and Middle America," 1896.

## The Agricultural Student.

Before Townshend Literary Society at Its Sixth Anniversary, Feb. 11, 1898.

By V. H. Davis.

I have been asked to say a few words about the "Agricultural Student." I suppose, because everyone can tell at a glance they have a specimen before them; but I do so with a special request to you not to judge all the agricultural students from a single specimen. Therefore it is the agricultural student as an average of his class, that we are to talk about this evening. I have no apologies to make for him; he needs none. I shall not eulogize him, he must speak for himself. I shall ask for him no special favors or honor in university life; if he wants either he will do in the future as he has in the past, win them by his own merit. I will simply talk to you for a few minutes as to why he is an agricultural student, his place in university life, and his possible prospects for the future.

In the life of every youth on the farm there comes a time, as there does in the life of every other youth, when the mind makes a rapid development and begins to grapple with some of the problems of life. So far in life he has rested in blissful security in a happy home, without much thought of the future; but the truth now comes to him, that in a few short years he must take his place in the great arena of life, and fight his own battle. This thought is not altogether unpleasant, for it is simply in harmony with his nature, and equally natural does the question of his future vocation arise, what, with my abilities, my opportunities and environments, can I best do, and in doing obtain the most happiness, and do the most good. Happy is he if he is allowed to settle this question for himself without the meddlesome interference of friends or relatives.

But we are to talk on the agricultural student, and by accident or otherwise his attention is directed toward the vocation of his father, and from this on we will consider him as an agricultural student. By the timely words of wisdom of some keen, practical mind, he is led to make a just comparison of agriculture with other professions, and it is needless to

say that agriculture has not suffered by the comparison. But why the general aversion to agriculture as a profession? In answer to this question he reaches the unpleasant, but truthful conclusion that the agricultural class has fallen behind in many ways in the universal and phenomenal advancement of the last century, but principally educationally and socially. This state of affairs is due, to a certain extent to the different conditions in the country and city where the other professions are chiefly centered; but the farmer holds both cause and remedy principally in his own hands, and must lay all the blame at his own door. While he has peacefully tilled his soil, away from the fierce competition of the business centers, he has forgotten in a measure his intellectual and social improvement, and when this competition begins to reach out into his avocation, he is not able to withstand the ever-operating law of natural selection and vainly looks for relief in every way but by his own mental improvement. Thus, our agricultural student sees, and ponders in his mind. He is taking lessons in sociology and political economy,for even now he beginsto see a bearing of the question of agricultural education on the great political and social questions of the present, as well as the future, and with a final survey of the whole question he chooses his life work. The die is cast and he sets his face resolutely to accomplish his purpose and fit himself for it in the best manner possible.

An agricultural education he must have, and of the best possible to obtain. He quickly finds that there is only one such place in his reach—the State University, and he begins to make preparations to enter as soon as possible. He sends to the university for a catalogue, and reads therein a very nicely worded article, which promises nothing but simply holds out great possibilities providing he does the work. This article does for him what it has done for many others, entices him here, and when here he finds himself in a position which brings out all the latent powers in him.

We will pass over many of the difficulties, common to all, in entering the university, such as registration by the "easy methods" now practiced. But he soon falls into his place, and devotes himself to his work and at the end of the first term he finds he has won the privilege of coming again, while some of his classmates have not been so fortunate.

Let us now pass to his senior year and compare the agricultural student now with the agricultural student that entered the university four years ago.

The first improvement which we notice is an external one, but is not without importance. When our agricultural student entered school, he had that indescribable something about him, by which he was singled out by the other students as an "ag.," half way across the campus. He has been described as acting like a fish out of water, and, indeed the comparison is a good one, for he is literally out of his element, but it is no fault of his that he makes a few breeches of university etiquette; they are mistakes of the head and not of the heart, and we see him now moving among his fellows as one of them, respected and honored.

When first called upon to rise and recite in class, he could not connect two single ideas and express them in intelligent English, not because he did not know what to say, but because he was not used to expressing himself while on his feet. But by constant effort he has overcome this defect to a great extent, and we now find him ready and able to talk with a moment's notice on not only subjects exclusively agricultural, but on anything from Darwin's Pangenesis or Weisman's theory of the germ plasm, to the latest topics in university life.

His primary object in entering the university was mental improvement. With a strong mind, in a healthy body, which simply lacked training, he has made good progress in powers of thought and he now finds himself master of whatever abilities he may have.

The temptations of city life have not affected him in his straighforward course. He has met them on their own ground and has been victorious, thanks to his early training.

We have heard the agricultural student spoken of as simply going through school, and not counting for much in

university life, but such is not the case. In his class his average is as good as, and sometimes better than the average of those in other departments.

In the battalion he is an earnest worker and usually leaves it with a high rank—often the highest—filling the offices with honor and commanding the respect of the cadets in general.

His interest in literary work is not lacking; his voice is heard in the leading literary societies in the university, both general and technical.

In the Y. M. C. A., sadly neglected by the student body, but which does the university more practical good than it gets credit for, we find the agricultural student, earnestly working for the good of all.

We have often heard the complaint that the agricultural student has no university spirit, he takes no part in athletics or university movements of any kind. It is a fact that there are not as many agricultural students found in athletic work as there should be, but there is a reason for this, often overlooked. The agricultural student must spend his extra time in lucrative employment and in case of his injury it would mean to leave school. But even in athletics the names of agricultural students are not wanting on the roll of honor.

Probably the most noticeable defect in the agricultural student after completing his course is socially. He is conscious of this lack when he enters college, but partly on account of his consciousness and partly on account of economic reasons, he has neglected this important adjunct of an education.He takes great pains and spends the best years of his life in collecting a set of thoughts for the conduct of life, and after all such qualification he shall hesitate in his speech to a good suit of clothes, and lack common sense before an agreable woman.

Graduation day comes at last, the agricultural student receives his degree and steps out into the great world to go through the crucial test of life.

It is a notable fact that in all reformatory movements, the greatest and most bitter opposition and discouragements come from those who are to be directly benefited. The greatest obstacle in the way of higher education in agriculture is the morbid indifference, if not the avowed opposition of the farmers themselves. There is no opposition from other professional men. They see and realize the benefits of an agricultural education to them as well as the farmer.

And now the question arises, in what way can the agricultural student best accomplish his purpose after he has finished his course. In the beginning of agricultural education the student himself seldom had any intention of returning to the farm, and we are glad of it. He was fitted to do more for his profession in other positions. But now the majority of the agricultural students return to the farm and demonstrate that higher education for the farmer is not a failure, but an infinite blessing to the whole community as well as himself.

Oh! knew he but his happiness. Of men
The happiest he who, far from public rage,
Deep in the vale, with a choice few retired,
Drinks the pure pleasure of a rural life.

But there is need of earnest, educated agriculturalists in other positions also. There is yet a great work to do in bringing the agricultural classes to realize the great need of a higher education. Instruction in the fundamental principles of scientific agriculture cannot be put off; it must be done immediately; and the doors stand open for teachers and experimenters all along the line. But whatever phase of agricultural work the student may enter, he shall be rewarded for his work by seeing the profession of agriculture take its place in the first ranks of the professions; and when it does, many of the perplexing social and political questions of the day will trouble us no more, and a new era of prosperity will come to all in every calling. The agricultural classes do not stand alone in this great movement; all will be benefited, but on the agricultural student of today will fall the burden of the work to be done. The following words of Landon are as applicable to him as to those of every other calling:

Few know of life's beginnings; men behold

The goal achieved—the warrior, when his sword
Flashes red triumph in the noonday sun,
The poet, when his lyre hangs on the palm;
The statesmen, when the word proclaims his voice,
And mould opinion on his gifted tongue;
They count not life's first steps and never think
Upon the many miserable hours, when
Hope deferred was sickness to the heart,
They reckon not the battle and the march,
The long privations of a wasted youth;
They never see the banner till unfurled.
What are to them the solitary nights—
Passed pale and anxious by the sickly lamp.
The crowd attend the statesmen's fiery mind,
That makes their destiny but they do not trace
Its struggle or its long expectancy.
Hard are life's early steps; and but that youth
Is buoyant, confident and strong in hope,
Men would behold its threshold and despair.

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## Agricultural Possibilities.

The following is taken from an address delivered at the Ohio State University, January 12, 1898, by H. W. Wiley, Chief of the Division of Chemistry, U. S. Department of Agriculture:

I have before me a bulletin of the Maryland Agricultural Station which gives a yield of wheat obtained on plots under proper culture in Prince George's County, Maryland. I find that this soil, which a few years ago was regarded as worthless for agricultural purposes, has yielded, under a scientific management, 40 bushels of wheat per acre. This is not a chance harvest, but one that has been often obtained, and one that can be obtained indefinitely.

The methods which are employed for securing these yields are well known. They can be easily and generally applied, being changed to suit changed conditions of soil and climate. With intelligence and care, such as the agricultural stations make possible to every farmer, these full harvests can be generally obtained. Thus, without adding anything to our present acreage, it is easily possible to increase our wheat yield threefold. Scientific agriculture to-day may safely undertake the task of feeding 240,000,000 Americans, and exporting 150,000,000 bushels of wheat without encroaching upon the area now devoted to any other crop.

But wheat is only a small part of our resources. Indian corn is quite as nutritious as wheat. Its content of protein matter is not gluten, and it does not make light and spongy loaves, but it does make bread highly nutritious and palatable. The average yield of Indian corn for the past ten years in this country has been 24.2 bushels per acre.

When I turn to the reports of the Kentucky Experiment Station I find a most striking lesson. We usually think of experiment stations as the helpers of the poor soils, but in the case of Kentucky we find one situated in the heart of the great blue grass region, one of the most fertile agricultural areas in the world. Chemistry, however, revealed the fact that this soil was poor in potash. When this cheap fertilizer is applied to the land we see at once the striking effects which the simple application of well known scientific truths produces. The year 1889 was one in which the climatic conditions were well suited to the production of Indian corn. In that year the yield on the Kentucky Experiment Station, on land to which no fertilizer was applied, was 31 bushels per acre. The yield on a portion of the same field which received muriate of potash at the rate of 160 pounds, and nitrade of soda at the rate of 160 pounds per acre, was

87 bushels. Thus, by the application of 320 pounds of fertilizing material per acre, half of which was obtained at a very low price, the yield of Indian corn was more than doubled. This illustration, it is true, represents an extreme case, that is, one in which the climatic conditions were especially favorable. But one of the greatest triumphs of scientific agriculture in the future will be found in the more practical control of climatic conditions than is at present secured. We will be able, on the one hand, to conserve the natural moisture so that the effects of dry seasons in diminishing a crop will be reduced to the minimum. On the other hand, we will be able to so control large excesses of precipitation that the sinister effects of an excessively wet season will likewise be reduced to a minimum.

In respect of temperature, there is little reason to fear, inasmuch as the average mean temperature of the growing season does not vary greatly in any period of the year.

A hundred years ago the ordinary garden beet contained only from 3 to 5 per cent. of sugar. To-day the sugar beet, which has been developed from this primitive form, contains 15 per cent. of sugar. In seven years of scientific agriculture, the Department of Agriculture raised the average content of sugar in sorghum from 9 to 14 per cent. Practically nothing has been done along this line with other standard crops, but it is perfectly certain that the character of any crop can be changed, almost at will, in accordance with the demands which may be made upon it. The protein content of wheat is now 12 per cent. It is safe to predict that a few years of careful scientific selection would increase this content to 15 per cent.

There is no time here to even mention the details of the work by means of which this desirable result can be accomplished. Protein matter is by far the most costly, pound for pound, of human food, with the possible exception of oils and fats. There is such an illimitable field of progress before us in the production of carbohydrates for foods that we look with interest upon any methods which may be devised for increasing the content of protein matter in such standard crops as our cereals. In other words, we may feel able to accomplish with all of our standard vegetable crops what has already been accomplished in the development of a dairy cow or a race horse. Thus not only do we see the prospect of increasing crops for a given area, but also of adapting the character of these crops more particularly for the purposes to which they are to be devoted.

There are good reasons, therefore, for believing that both in respect of moisture and temperature, the agricultural science of the future may open up large areas to tillage that are now abandoned to desolation and to frost. Even in Alaska we read accounts of gardens and fields of cereals and of meadows for grazing cattle. In the recovery and utilization of waste products the farmer of the future has spread before him a field of richest promise. It has been shown that with the proper culture and feeding the yields of our fields may be increased three fold. * * * The chemist of to-day is attacking vigorously the problem of building up compounds as complicated as the proteids. I am, however, not a believer in the possibilty of chemistry ever displacing agriculture and forming from the inorganic elements all the food necessary for man and beast. Lately, in an address before the American Chemical Society, in Boylston Hall of Harvard University, I reviewed this whole subject, and it is not necessary now to do more than refer to it. In that address I said:

"According to Berthelot, the fields which are now defaced by agriculture will be beautified by regaining their natural covering and the earth will be one vast park of pleasure and the chemist the great conservator of the human race."

"In all the instances brought forth there is not the slightest approach to anything to justify the prophecy of a period of artificial food. The few cases of synthesis in which the products ap-

proach the composition of anything digestible present such insurmountable difficutlies in expense and supervision as to render any expectation of reaching economic results utterly futile. In the great majority of cases, as has been seen, the process of synthesis is conducted on materials already organized by living cells. The enormous cost of building up any kind of a commercial, synthetic organic body directly from the elements is such as to render it, in my opinion, utterly improbable of successful achievement.

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### Pasturing the Wood-lot.

In the March number of the Farm Student's Review, of the Minnesota School of Agriculture, we see the following reasons why the wood-lot should not be pastured:

1. The pasturage obtained from woods is very scant and of poor quality.

2. The woods themselves are a crop, and a growing crop, and the effect of pasturing is to almost destroy this growth.

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### Recent Books.

FEEDS AND FEEDING, by W. A. Henry. Published by the author, Madison, Wisconsin. Price $2.00.

Prof. Henry is well known as an authority upon the subject of feeding, and his own reputation is a sufficient recommendation for this work. The intent of the author has been to make this work a practical handbook for the student and stockman, and as is stated in the preface, "that feeding is an art and not a science, and that experience and judgment must rule in its successful conduct, is recognized by placing on the title page the adage, 'The eye of the master fattens his cattle.'"

The book is the result of years of work, and has been expected for some time. The general make-up of the work shows extreme care in preparation, and in selection. One of the valuable features of the work is that it compiles in a concise form the results of all of the principal and valuable experiments which have been made in this line.

The work is divided into three divisions or parts as follows:

Part 1. PLANT GROWTH AND ANIMAL NUTRITION. This part consists of seven chapters upon the plant, manner of growth, mastication, digestion and assimilation by animals, animal nutrition, source of muscular energy, influence of feed on the animal body, methods of calculating rations, etc.

Part II. FEEDING STUFFS. Considers all of the leading farm crops and their by-products, feeding values, etc. Nine chapters.

Part III. FEEDING FARM ANIMALS. This part consists of nineteen chapters on stock feeding. Methods and rations for feeding horses, cattle, sheep and swine are given. The book goes into minute detail and gives experiments to prove all of its assertions.

Taking everything into consideration, we consider it as inferior to no other treatise upon the subject with which it deals. The fact that it has been adopted as the text-book in the classes in agriculture at this University goes to prove its excellence. It should be in the possession of every student and farmer.

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WATER COLOR PAINTING, by Grace Barton Allen, Boston; Lee and Shepard.

Water color painting, by Grace Barton Allen, with illustrations and cover design by the author, also containing colored plates showing washes of modern water colors. Cloth.

This volume, which is a practical textbook on the art of painting in water colors, is intended for the use of amateurs, and of those water color teachers who are not yet sufficiently accustomed as instructors to realize how much the average pupil does not know. Taking for granted absolute ignorance on the part

of the reader, it explains, as far as may be done in print, the technicalities of this branch of art in simple and intelligible language, treating of colors and materials, as well as of flower, landscape, and figure painting in polychrome and monochrome. The author, who has had experience with both public classes and private pupils, aims to convey information in so clear, direct and minute a way that there shall be no possibility of misconception, and has illustrated the book with chapter headings and tail pieces which serve as a commentary on the text. The washes of color given in the volume will prove to be of great value to the amateur as well as the artists. Price $1.25.

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A LABORATORY MANUAL IN PRACTICAL BOTANY, by Charles H. Clark, A. M. D Sc., Cincinnati. American Book company. Price 96 cents.

This book is intended as an elementary text-book in botany, for high schools and colleges. The principal feature of the book is the study of the life history of the plant, modes of reproduction, manner of life, etc. While it is a laboratory manual, the work is so arranged as to give the student a good idea of the general description of plants, and a definite plan of the steps in the development of the plant from the beginning. Practical work in analysis is prescribed by the book, and simple laboratory studies of the higher plants are made. The student is then taken up through the development of the vegetable kingdom, from the highest to the lowest forms. The book is well balanced and gives due notice to all divisions of plants. Specimen pages may be had by sending to the publisher.

---

THE PAINTER IN OIL, by Burleigh Parkhurst, Boston; Lee and Shepard.

A practical treatise on the theory and processes of oil painting by Burleigh Parkhurst, pupil of William Sartain, of Bouguereau and Tony-Fleury and of Aimee Morot, formerly lecturer on art in Dickinson College. Author of "Sketching from Nature,' etc. Fully illustrated and containing colored plates showing specimens of oil colors.

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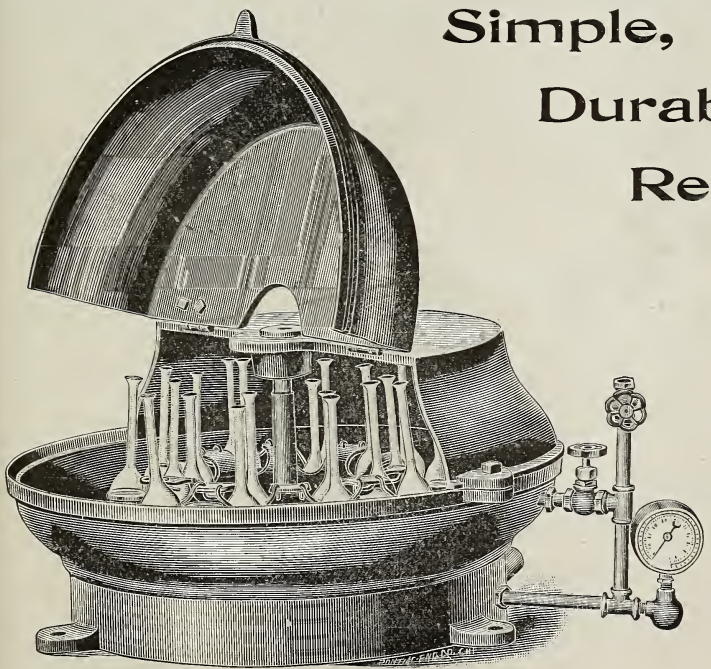

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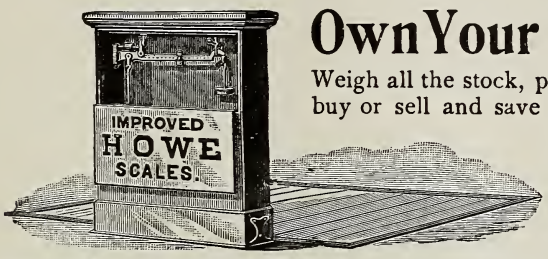


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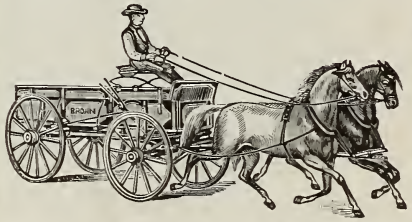


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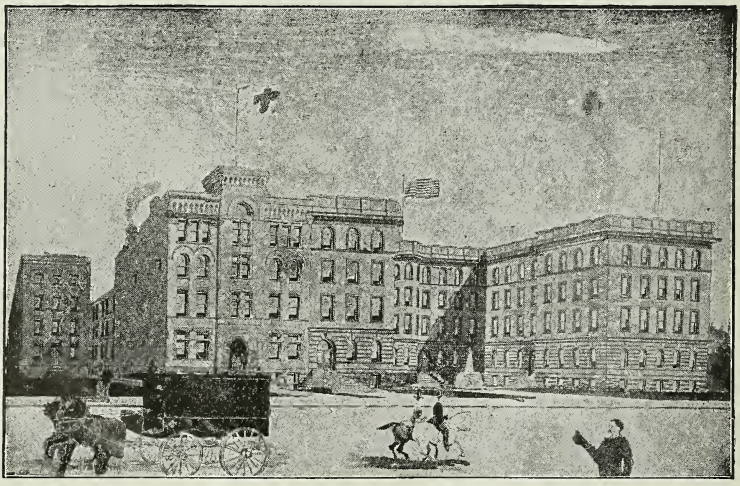

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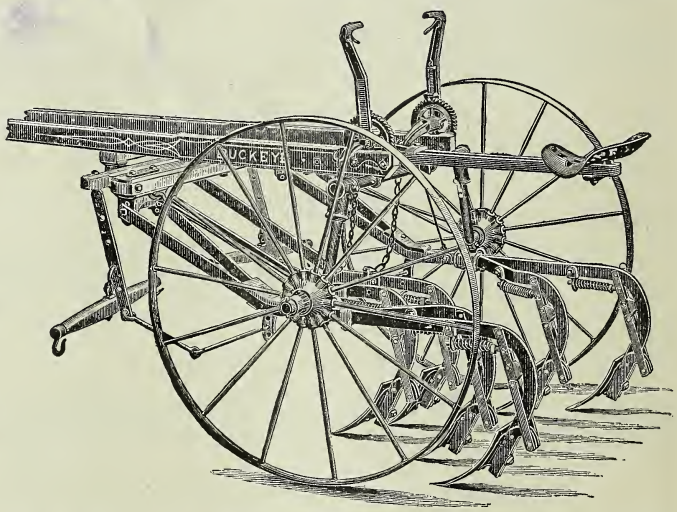


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